

Abstract

In partnership, Adams State College (ASC) and the South Conejos RE-10 school district will develop and implement a performance-based model of professional development. This model will focus on mathematics and science, to assist rural school districts in ensuring a highly qualified teachers and effective learning for all students. The performance products resulting from this model include 1) an articulated, K-12 Mathematics and Science curriculum that incorporates Colorado State Standards in Mathematics, Science, Literacy (Reading, Writing), and English Language Development, with dissemination of the model and curriculum through 2) presentations at professional conferences and publications in practitioner and research journals, and 3) professional development activities for vertical teams of teachers from high poverty school districts in the region during a Summer 2008 Mathematics and Science Academy, utilizing the project model and elements of the curriculum. Project sustainability will be systemic: a) providing professionally prepared cadre of K-12 teachers, b) establishing vertical curriculum teams, 3c) implementing a mathematics and science curriculum, and d) continuing a partnership between the district and ASC for field placement of mathematics and science methods student in teacher preparation programs.

Narrative

This collaborative partnership will provide a model of curriculum development and teacher professional development for a small, rural school district. Unlike urban school districts, the principals and superintendents of rural districts are the providers for curriculum, ELL, assessment, and professional development. Thus, collaborative partnerships between teacher education programs and K-12 districts provide much needed expertise. In Colorado, 30 school districts serve the urban areas along the Front Range while the remaining 147 districts are found in outlying areas that include small cities, towns and rural areas.¹ Schools in these outlying rural communities face

¹ CDE, Fall 2002 Pupil Membership by District Setting, report prepared by the Data and Research Unit, 3/14/2003.

unique challenges in providing for curriculum development and teacher professional development training. “In [these outlying and] rural areas, where poverty rates are often as high as those of urban centers, low teacher salaries combined with social, geographic, cultural, and professional isolation make it difficult for rural schools to compete with wealthier communities for qualified teachers.”²

This proposed collaborative project responds to the teacher quality and curricular challenges of effective mathematics and science instruction for all students in the context of the small, rural school district. First, the South Conejos School District has high poverty rates 21% (71% averaged free and reduced lunch) and declining academic performance in mathematics and science as the students progress through grades 3-10 (CSAP 2006: Proficient and Advanced: Mathematics –grade 3-76%, grade 5-48%, grade 7-5%, grade 10-5%; Science grade 5-31%, grade 8-49%, grade 10-29%). Second, this district was selected for partnership because of the effective instructional leadership that resulted in significant increases in literacy scores. This increase is attributed, by the elementary principal, to a process of professional development that focused on: a) content and research based instructional practice, b) accountability tied to on site coaching, and c) a clearly articulated curriculum that included standards, benchmarks, and framework.

Further, the concept of highly qualified teacher, is extended in this project to include both content knowledge as well as knowledge and skills of research based instructional and assessment practices that will support the academic achievement and success of all students.

Objectives

This project will focus on four (4) objectives:

1. Design and implementation of a professional development model for rural pre-service and in-service K-12 teachers.

² Gene R. Carter, Is it good for kids? NCLB and the Diverse Needs of Rural Schools. Retrieved from <http://www.ascd.org/cms/index.cfm?TheViewID=1905> on 12/1/03. See also Doris Terry Williams. 2003. Rural Routes to Success. Educational Leadership 61 (3): 66-70.

- 1.1. Providing pre-service teachers with field placement in the partner schools and involvements in project activities during their science and mathematics methods courses, and
- 1.2. Providing in-service teachers with 2 courses in workshop format that address science and mathematics content, curriculum and instruction using standards based, inquiry/problem based instruction, and assessment.
2. Development and implementation of a comprehensive K-12 mathematics and science curriculum³ for a small, rural district that integrates Colorado state content⁴, literacy and English Language Development (ELD) standards.
3. Design practical assessments of effectiveness that measure teacher and learner outcomes:
 - 3.1. teacher knowledge of content and standards, beliefs and dispositions about science and science learning, and knowledge of effective instructional practices, and implementation of effective instructional practices;
 - 3.2. K-12 student engagement and learning; beliefs and dispositions about science and science learning, and academic performance. including standardized test data (CSAP).
4. Dissemination of project model and curriculum.
 - 4.1. Data collection and analysis throughout the project.

³ Harlen, W. (2004). Evaluating inquiry-based science developments. A Paper Commissioned by the National Research Council in Preparation for a Meeting on the Status of Evaluation of Inquiry-Based Science Education; Institute of Educational Science, USDOE (2003). Teacher supply and demand in the state of Colorado; Klahr, D., & Nigam, M. (2004). The equivalence of learning paths in early science instruction: Effects of direct instruction and discovery learning. *Psychological Science*, 15(10), 661-667; Legleiter, E. (2005). Modeling: Changes in traditional physics instruction. In Yager, R. (Ed.), *Exemplary practices for 9-12 classrooms*. Arlington, VA: National Science Teachers Association Press; Magnusson, S. & Palincsar, A.. (2005). Teaching to promote the development of scientific knowledge and reasoning about light at the elementary school level. In NRC, *How students learn history, mathematics and science in the classroom*. Washington, DC: The National Academies Press; Marzano, R., Pickering, D., & Pollock, J. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Alexandria, VA: ASCD ; Minstrell, J. & Kraus, P. (2005). Guided inquiry in the science classroom. In NRC, *How students learn history, mathematics and science in the classroom*. Washington, DC: The National Academies Press.

⁴ Bransford, J. & Donovan, M. (2005). Scientific inquiry and how people learn. In NRC, *How students learn history, mathematics and science in the classroom*. Washington, DC: The National Academies Press; Bybee, R. (1997). *Achieving scientific literacy: From purposes to practices*. Portsmouth, NH: Heinemann; Keeley, P. (2005). *Science curriculum topic study: Bridging the gap between standards and practice*. Thousand Oaks, CA: Corwin Press; National Research Council, (2000). *Inquiry and the national science education standards*, Washington, DC: National Academy Press; National Research Council, (2002). *Helping children learn mathematics*. Washington, DC: National Academy Press; Schmidt, W., Wang, H. & McKnight, C. (2005). Curriculum coherence: an examination of US mathematics and science content standards from an international perspective. *Journal of Curriculum Studies*, 37(5), 525-559.

4.2. Presentations at professional conferences,

4.3. Involvement of rural K-12 teachers and students from other districts in a Summer 2008 Mathematics and Science Academy.

The project time frame will be October 1, 2007 until December 31, 2008.

Participants

Adams State College and the South Conejos School District are located in the San Luis Valley (SLV), at the head waters of the Rio Grande and the southern edge of the state. The San Luis Valley covers 8,000 square miles. This SLV region includes two of the highest poverty counties in the nation, Conejos and Costilla. The South Conejos RE-10 District is in Conejos County. According to the U.S. Census 2006 projection, Conejos county has a population of 8,406 (55.9% Hispanic, 42.9% White non-Hispanic), a per capita income of \$12,050, and declining non-farm employment (-12.7%). The county covers 1,287 square miles.

The South Conejos District RE-10 has one elementary school, one middle school, and one high school. The district staff includes one superintendent, two principals, twenty-eight teachers (full and part-time - 69% teaching in subject in which they received their degree), and four paraprofessionals. There are 280 students in the district.⁵ Two secondary science/mathematics teachers and all fourteen elementary teachers will participate in the project.

There are 17 districts in the San Luis Valley, ranging in student population from 186 to 2,250; eleven of these districts make up 31% of the high poverty districts identified by the U.S. DOE as high need. In addition to S. Conejos District, teachers and students from 10 additional high need school districts in the San Luis Valley will be included during the summer Mathematics and Science program, expanding the capacity of the project. Vertical teams of three teachers from five districts and 30 students (grades 4-10) will be served.

⁵ South Conejos RE-10, School Accountability reports (2007), retrieved from <http://reportcard.cde.state.co.us/reportcard/CommandHandler.jsp>

As a regional education provider, Adams State College (ASC) is mandated by the State of Colorado to identify and serve the educational needs of the SLV region. In collaboration with ASC's School of Math, Science and Technology, the Department of Teacher Education is well prepared to support the identified needs for mathematics and science education in the regional school districts. Adams State College is also a federally designated Hispanic Serving Institution (HSI) receiving Title V funding. The Department of Teacher Education provides teacher preparation programs (elementary, secondary, K-12, Masters Plus) and masters programs with preparation for licensure endorsement (Principal, Reading Teacher, Linguistically Diverse, Special Education). The Department of Teacher Education has effectively administered grants supporting professional development including NCLB (2004, 2005, 2006), Teacher Quality Enhancement-TQE (2003-2006), Office of English Language Acquisition (2001-2003, 2002-2007, 2007-2011), Office of Special Education Programs (2004-2007). Deborah Blake, PhD, Department of Teacher Education, will serve as the project's PI. Dr. Blake has designed and taught higher education elementary and secondary science methods courses, has administered NCLB grants, and has experience teaching secondary science. Pre-service teachers in the Adams State College Teacher Preparation program will participate in the project through their field placement (20 hours) in classrooms in the partner districts as a part of their mathematics and science methods courses (approximately 20 students per semester).

In addition, consultants include Jeff Farmer, PhD (Mathematics Education), Sara Manzanares, M.A. (Literacy and English Language Learners), and Joanna Bruno, M.A. (Science Education).

Activities

Fall 2007

1. Beginning October 2007, the PI and the three educational consultants will assess current pre-service and in-service teacher knowledge of content and standards, beliefs and dispositions, effective inquiry based instructional practices, and actual instructional practices in mathematics and science instruction. A modified dispositional survey, sheltered instruction observation protocol (SIOP), content assessment (PLACE and PRAXIS II scores and selected CSAP elements), and interviews will be used. K-12 students will be assessed for engagement and learning, beliefs and dispositions about science and science learning, and academic performance using an observer rubric, informal dispositional assessment, and review of formal assessment records.
2. ASC pre-service teachers enrolled in mathematics and science methods coursework at Adams State College will be assigned field placements within South Conejos schools. Dr. Blake is the instructor for the science methods course and will be the field supervisor for both courses. Students will participate in instruction, conduct observation and do data recording using observation protocols, assessment of student learning, and development of instructional activities that support the new mathematics and science curriculum.
3. Using a vertical team model, in-service teachers engage in a two credit course (workshop format) on curriculum and assessment; engagement with the science and mathematics; Colorado standards in mathematics, science, literacy, and ELD; backward design framework; instructional practices including inquiry based strategies; and science and mathematics content. The product will be a thematic strand for the mathematic and science curriculum, to be field tested in Spring 2008.
4. Proposals will be submitted to professional conferences for two presentations in Fall 2008 (i.e. National Science Teachers of America-NSTA, National Council of Teacher of Mathematics-NCTM, National Association of Bilingual Education-NABE, and Regional NSTA, Colorado

Council of Teachers of Mathematics-CCTM). The PI, one secondary and one elementary teacher will make up the presentation team.

5. Human subjects review by ASC Institutional Review Board for approval, as well as consent documents, will be provided to the various participants.

Spring 2008

1. Field testing of the mathematics and science curriculum strands developed in Fall 2007. Both pre-service and in-service teachers participate in implementation and review phases of this test..
2. The consultants will participate as classroom coaches and mentors, working on-site for three days (math and science 3 visits, ELL 1 visit), as well as observing implementation and meeting with teachers.
3. In-service teachers will participate in a two credit course (workshop format). In vertical teams, either mathematics or science, they will develop additional vertically articulated curriculum units and field test as feasible. Teams are to meet after school and during three workshops during the semester; pre-service teachers participate as part of their field practicum assignments.
4. ASC pre-service teachers enrolled in mathematics and science methods coursework at Adams State College are assigned to field placements at South Conejos schools. They participate in instruction, observation, and data recording of instructional activities using observation protocols, assessment of student learning, and development of instructional activities that support the new mathematics and science curriculum.
5. The PI and consultants will continue data collection about implementation processes through field notes and observational protocols. Consultants will be working with PI in the areas of planning and review of project progress.
6. The PI will oversee the review and revision of mathematics and science methods courses for pre-service teachers to further correspond to project emphases and data.

7. Planning of Summer 2008 Mathematics and Science Academy, including identification of two lead teachers from S. Conejos schools as academy instructors and the recruitment of 5 vertical teams of 2-3 teachers and 30 students from region.

Summer 2008

1. Vertical teams will work on completion of articulated mathematics and science curriculum (June 2008) with assistance from the PI.
2. Summer 2008 Mathematics and Science Academy will include a one week workshop followed by one week working with students for teachers from SLV region, high poverty districts. The workshop content will cover curriculum development, mathematics and science content, standards (mathematics, science, Literacy and ELD), problem-based and inquiry instruction, and assessment. Two teachers from the South Conejos District will serve as instructors with support from the PI. During the second week, students (grades 4-10) will participate in the Academy. The span of grade levels provides for differentiated instruction and learning communities. This grant funds stipend and materials costs for both teachers and students. This Academy is based on further development of previously successful NCLB funded summer math academies in the SLV.
 - a. Data collection includes observations of student engagement, student and teacher dispositions, student and teacher content knowledge, and teacher knowledge of instructional strategies.
3. Continuation of data collection and analysis coordinated by PI. Development of conference presentations and papers.

Fall 2008

1. Implementation of the K-12 curriculum in mathematics and science.

2. Use of two district professional development days for orientation and assessment using leadership of selected district teachers and the PI.
3. Presentations at two conferences by PI, one secondary teacher and one elementary teacher.
4. The consultants work on site for two day periods (1 visit per consultant) to monitor implementation and provide additional coaching.
5. Writing and submission of co-authored articles for publication, one in practitioner journal and the other in a research journal.
6. Development of final report.